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Gary Perlman

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TWO PAPERS IN COGNITIVE ENGINEERING:

**THE DESIGN OF AN INTERFACE TO A
PROGRAMMING SYSTEM**

AND

**MENUNIX: A MENU-BASED INTERFACE TO UNIX
(USER MANUAL)**

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ABSTRACT

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THE DESIGN OF AN INTERFACE TO A PROGRAMMING SYSTEM

AND

MENUNIX: A MENU-BASED INTERFACE TO UNIX (USER MANUAL)

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ABSTRACT

This report consists of two papers on MENUNIX, an experimental interface to the programs and files on the UNIX operating system. In the first paper, I discuss how the decisions about the design of MENUNIX were made: based on my intuitions and user comments, but also on psychological theory and data whenever available. MENUNIX presents both the programs and files of UNIX in two menus from which users can make selections with single keypresses. The FILE menu presents the UNIX file hierarchy that allows users to organize files into directories by subject (e.g., writing and programming). The PROGRAM menu presents UNIX programs in a hierarchy organized into workbenches according to the tasks for which they are used (e.g., writing and programming) much as files can be organized in directories. Special facilities are provided for: finding out about useful commands; using variables to set options, to save commands, and to avoid typing long strings; and for editing strings (including recent commands). The second paper is a tutorial user manual for MENUNIX, in which the features of the program are more fully explained.

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THE DESIGN OF AN INTERFACE TO A PROGRAMMING SYSTEM

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ABSTRACT

In this paper I discuss the design decisions made in programming MENUNIX, an experimental interface to the files and hundreds of programs of the UNIX operating system. Both programs and files are presented on the terminal screen in fixed location menus from which users can make selections with single character selectors displayed beside menu entries. MENUNIX organizes UNIX programs into a hierarchy in which related programs are grouped together into task-oriented workbenches, much like the way UNIX allows files to be grouped into directories. I first give a brief introduction to MENUNIX and then discuss how MENUNIX tries to be friendly to users by increasing the accessibility of programs for novices, increasing the speed of command construction for experts, and decreasing the probability and impact of errors. Psychological theory and data are referred to in support of design decisions.

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Getting Documentation

By typing the Execution/Documentation character, `?`, you change perspectives on the PROGRAM MENU. Ordinarily, selecting a program causes its execution, but by typing a `?`, you switch into a mode in which the next PROGRAM MENU program you select will cause MENUNIX to look for documentation on that program, even if it is a MENUNIX [CONTROL] command. Once you get documentation on a program, MENUNIX automatically puts you back in the execution perspective. The `?` is really a toggle for changing perspectives, so if you go into the documentation perspective and you want out, another `?` changes you back.

Entering Information: MENUNIX's One-Line Editor

Many commands require you to supply information, such as the names of file arguments, or option setting flags. To do this, MENUNIX has you enter information in a one-line editor, called Line-edit, located at the bottom of the screen. Line-edit allows you to include and delete characters from anywhere inside a line you are editing, as well as insert variables in responses. When MENUNIX puts you in Line-edit, it is generally to provide some information for a command it is going to be running. MENUNIX automatically starts you in "appending text" mode; everything you type is entered into a buffer. When in "append" mode, you can enter text and follow with a RETURN, and MENUNIX will receive what you have typed. This will be a common use of Line-edit, however there are times when you will want to change something you have typed, or perhaps a variable or recent command, and you will want to get into the middle of a line and make changes. For this, Line-edit has "cursor mode" in which you can move the cursor to any point in the line and make changes.

Moving the cursor. In cursor mode, you can move to the right or left with the keys labeled with arrows (if your terminal is so equipped). An `l` (letter 'el') moves you one character forward (as does a space, `+`, or `CTRL-l`), and an `h` moves you one back (as does backspace and `-`). Capital letters tend to apply to a whole line rather than just a character. An `L` moves you to the far right of the line, an `H` to the far left. You can move forward or backward a word at a time with `w` or `b` respectively.

Adding new text. To append text after the cursor, type `a`, and to append text after the end of the line, type `A`. To insert text before the cursor, type `i`, and to insert text before the beginning of the line, type `I`. Minor mistakes can be corrected by backspacing. Once in an adding text mode, you can return to cursor mode by typing the key labeled `ESC` (for escape). Alternatively, you can type RETURN and MENUNIX will immediately read what you have typed.

File selection mode. In an adding text mode, you can go into a file selection mode in which the names of files are added to your edit line as you type the selector numbers beside their names. File selection mode is entered by typing the file selection character, the underscore, `_`. In this mode, every time you type the number beside a file name, that file name is added to your edit line. To stop this mode, you can repress the underscore, which will return you to the editor in an adding text mode, or press RETURN to send your edit line to MENUNIX.

Mistakes. In cursor mode, typing an x removes the character under the cursor. A zero, 0, deletes the contents of the editor from the cursor to the end of the line. A capital X clears the whole line and automatically puts you into append mode. Any mistake you have just made can be undone by pressing u which gives you back your edit line as it was before the last change. If you have really messed things up, you can type U which gives you the line you began editing, which is unfortunately often nothing.

Stopping line-edit. A RETURN will always send what you have typed to MENUNIX, regardless of mode. In cursor mode, a q can also be used to quit editing. If you do not want MENUNIX to look at what you have typed, say to abort a command, you can type Q. Also, if you are really desperate, you can type BREAK, and MENUNIX will ask you if you want to quit MENUNIX completely.

Summary of Line-Edit Commands

a	append text after the cursor
A	append text after the end of the line
b	back up one word
h	move the cursor back one character
H	move the cursor to the beginning of the line
CTRL-h	go back one character and delete if adding text
l	move the cursor forward one character
L	move the cursor to the end of the line
q	leave Line-Edit and pass back contents
Q	leave Line-Edit and stop command
u	undo the last change
U	undo all changes
w	forward one word
x	delete the character below the cursor
X	delete the contents of the editor and insert
0	delete from the cursor to the end of the line
+	move the cursor forward one character
-	move the cursor back one character
-	enter or leave file selection mode
-	ignore the special meaning of the next character
ESC	stop adding text

The Menu Definition Language

Just as you have control over the files in your file system, you can change the structure of the PROGRAM MENU hierarchy. A predefined variable in MENUNIX is `menu` that holds the name of the directory holding files that define the PROGRAM MENU hierarchy, that contains two special files: `UNIX` which defines the `[UNIX]` workbench and all subsidiary workbenches; and `CONTROL` defines the `[CONTROL]` workbench of commands available at all parts of MENUNIX.

In `$menu` is a file called `UNIX` that has lines that define

- (1) The name of each entry in the `[UNIX]` workbench,
- (2) The one character selector for that entry,
- (3) The type of the entry (whether the entry is that of a workbench or a program). For program entries, arguments may be supplied.

Each part of a workbench entry is defined by a bracketed field of the form:

`[NAME:VALUE]`

where `NAME` specifies the name of the field, and `VALUE` specifies its value. For example, the `[UNIX]` workbench has the definition:

`[display:UNIX][selector:.] [menu:UNIX]`

This definition says that "UNIX" should be displayed on the right of the selector character "." and that its selection will cause the display of a menu whose definition is in the directory `$menu` in a file called "UNIX." An example of a program entry is that for the copy command:

`[disp:Copy files][sel:c][prog:cp][args:{files} {destination}]`

which says that "Copy files" should be displayed on the right of the selector character "c" and that its selection will cause the execution of the UNIX `cp` command.

c Copy files (cp)

Since there is an argument field, MENUNIX knows to append it to the call to `cp`. Anything in the argument field is interpolated and copied unless there is a part of the field enclosed in curly braces. MENUNIX uses the convention that anything in curly braces is to be used as a prompt to get a response from the user. For each of the braced parts of the argument `VALUE` field, MENUNIX presents that part to the user and replaces it with the interpolated response typed in.

As a summary, each line of a workbench file defines a workbench entry that is either for another workbench (defined in an other file), or a program that may have arguments that the user may have to supply. Each entry is divided into `[NAME:VALUE]` fields. The names of these fields (that may be abbreviated to just one character) are listed below, along with a description of their uses.

<code>display</code>	Defines what is displayed.
<code>selector</code>	Defines the character to be used to select the entry.
<code>menu</code>	Defines that the entry is that of a workbench menu. the <code>VALUE</code> field holds the name of the file in <code>\$menu</code> that contains the definition of the menu.
<code>program</code>	Defines the name of the UNIX program to be executed when the entry is selected. If the entry is for a workbench, this field is ignored.
<code>arguments</code>	Supplies information to be appended to a UNIX command defined by the program field. This information can be regular text, including variables, which is interpolated and appended, or it can be enclosed in curly braces, which is replaced by the interpolated response obtained from the user after presenting the braced pattern.
<code>waitoff</code>	Tells MENUNIX to clear the screen and redisplay without user permission after a UNIX program has been executed. Without this field, MENUNIX asks permission with a prompt. The waitoff field has no value.

Defining the [CONTROL] Workbench

The [UNIX] workbench is defined by a special file in the \$menu directory, \$menu/UNIX. Another special file, used to define the [CONTROL] workbench, is \$menu/CONTROL. The definition for \$menu/CONTROL is just like any other workbench, but the commands in [CONTROL] are available at all parts of the PROGRAM MENU. This is because MENUNIX searches menus in a specific order for the selector character typed. First MENUNIX sees if the user has typed any of the numbers 1-9, used to access file entries. Then MENUNIX checks [CONTROL], and finally the current workbench. This means that the numbers 1-9 are permanently reserved, and that any characters in [CONTROL] should be carefully selected because they will not be available for any other menus.

The programs that are used in [CONTROL] should also be carefully selected because only fifteen entries are allowed. The entries should be reserved especially for the commands MENUNIX uses to control the display, called internal commands whose names are preceded by a minus. The internal commands available are listed below. After the letter is its default selector character in parentheses. In \$menu/CONTROL, the selectors for these internal commands are defined, so if you don't like using a selector, you can choose your own.

MENUNIX Internal Commands

u(.)	changes the workbench to [UNIX]
a(:)	changes the workbench to [UNIX] and returns
f(&)	flips the PROGRAM MENU display to [CONTROL]
p(.)	changes the workbench to the parent menu
o(o)	changes the working directory to the parent directory
c(/)	changes directory
+(+)	displays the next directory page
-(-)	displays the previous directory page
d(?)	changes to and from the documentation perspective
s(!)	runs a command typed in the line-editor
v(\$)	sets a variable to a value
i(#)	prints the value of a string or prints all variable values
r(CTRL-r)	redispays the screen

Making Your Own Menu System

Changing \$menu makes it possible to customize the PROGRAM MENU hierarchy to your liking. when you fire up MENUNIX, you can add an argument to the program call that sets menu. This must be the complete pathname of the directory with the files defining the PROGRAM MENU hierarchy. To make your own PROGRAM MENU hierarchy, you would create a directory with the files UNIX and CONTROL, which refer to other files (containing workbenches) in the directory you supplied to the call to MENUNIX. A good way to begin is to copy all the files from the standard \$menu to your preferred \$menu, and then make modifications.

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